Development of a clinical-grade extracorporeal liver support system using human induced pluripotent stem cell-derived hepatic cells

Grant Award Details

Development of a clinical-grade extracorporeal liver support system using human induced pluripotent stem cell-derived hepatic cells

Grant Type: Tools and Technologies III

Grant Number: RT3-07670

Project Objective: We propose to bring the 600mL 3D bioreactor technology to California and develop a clinical grade ELS with human iPSC-derived functional hepatocytes.
Another bottleneck is the laborious process of expanding stem cells to obtain a sufficient number of cells to use as the starting material. In this collaboration, our academic partner PI will address the bottleneck of efficient human PSC expansion using the 3D bioreactor.

Investigator:

Name:	Toshio Miki
Institution:	University of Southern California
Type:	PI

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Name:	Katrin Zeilinger
Institution:	Charité Universitätsmedizin
Type:	Partner-PI

Disease Focus: Liver Disease

Collaborative Funder: Germany

Human Stem Cell Use: iPS Cell

Award Value: $1,257,011

Status: Active

Progress Reports

Reporting Period: Year 1

View Report

Grant Application Details

Application Title: Development of a clinical-grade extracorporeal liver support system using human induced pluripotent stem cell-derived hepatic cells

Public Abstract: Liver failure is the fourth leading cause of adult death in California. Because liver cells can regenerate, some patients with liver failure could be saved without having to undergo organ transplantation if their liver function could be supported temporarily. Here, we propose to develop a device to support these patients called the “extracorporeal liver support system (ELS).”

Numerous pre-clinical studies and clinical trials have demonstrated the therapeutic effectiveness of ELS using human or animal liver cells housed in a device outside of the patient’s body but connected to the patient's circulation. The device removes toxins and prevents irreversible brain damage while the patient regenerates his or her own liver cells. However, the limited availability of human cells and insufficient functionality of animal cells prohibits this therapy from being widely adopted.

For this project, we will develop ELS using human stem cell-derived liver cells (hPSC-Hep) that will overcome two major bottlenecks in the translation of human stem cell therapies: scalability and safety. The unlimited supply and consistent quality of hPSC-Hep will allow us to make ELS scalable. By keeping the hPSC-Hep in a device separate from the patient’s body, we will also be able to allay any safety concerns about these cells forming tumors.

The result will be a widely available, safe and effective treatment that will alleviate the need for liver transplants for certain patients.

Statement of Benefit to California: Liver disease is a leading cause of death in California. California’s rate of 10.6 deaths per 100,000 people exceeds the national average of 8.8. To mitigate this problem, we propose developing a clinical device that can temporarily perform liver functions until a patient’s own liver cells recover. The device will use stem cells as a source of unlimited and quality controlled liver cells. Because the device is outside of the patient’s body, these stem cell-derived liver cells will remain separate from the patient’s blood stream, overcoming any risk of tumor formation. If successful, the device will be the leading choice for treatment, and will allow patients to recuperate without undergoing costly liver transplantation, which places an economic burden on patients' families as well as society.
Furthermore, the production of this device could constitute a novel industry that would provide job opportunities to the citizens of California. If successful, our industrial partner plans to launch a new California-based company in the near future.
The benefits of this new regenerative therapy will have a tremendous impact on the state of California and the thousands of patients suffering from liver diseases.